DESCRIPTION FOR THE GENERAL PUBLIC

Properties of materials determined by their size are indeed still fascinating. Depending on the nature of materials, changes in the physicochemical properties of nanomaterials are often the result of the quantum limitations of electrons in the small nanoparticles or an increased ratio the number atoms on a surface and a subsurface to these an inside the particle. The aim of the project is to investigate an influence of size of bismuth orthovanadate ($BiVO_4$) co-doped with Tm^{3+} and Yb^{3+} ions on efficiency of energy transfer processes in the luminescent material (phosphor). In particular, phonon-assisted energy transfer (ET) processes occurring between a $BiVO_4$ host and a dopant ion as well as energy conversion processes such as downconversion and upconversion between pairs of dopants acting as a donor and an acceptor will be studied. The obtained materials will be thoroughly characterized in terms of their structural properties by using X-ray diffractometry (XRD) and high-resolution electron microscopy methods. Next, spectroscopic properties by using measurements of the absorption spectra, excitation spectra, emission spectra in the visible and infrared range, luminescence kinetics and quantum yield of luminescence will be studied, with a detailed description of the energy transfer processes occurring in them and an influence of size effect. The size of the obtained nanocrystals will be determined on the basis of the obtained XRD patterns and by using the DLS method.

Considering the current development of nanotechnology, whose requirements also take into account the design and production of luminescent materials at the nanometre scale, it is important and interesting to study the processes of energy transfer and their efficiency in nanoscale materials. Proposed in the project material may be excellent alternative to well-known phosphors commonly used as luminescent converter. As a result, obtained results of the project will improve our understanding of the behaviour and properties of luminescent materials in the nanoscale. In addition, obtained conclusions, will facilitate further optimization of proposed materials for their applications e.g. as optical concentrators to improve the efficiency of photovoltaic solar cells.